Giant Electrocaloric Effect in Relaxor Ferroelectrics for Dielectric Refrigeration

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Materials with large electrocaloric effect (ECE) have the promise of realizing dielectric refrigeration which is more efficient and environmentally friendly compared to other techniques [1]. Although ECE has been studied for many decades, the relatively small ECE observed <2.5 ^{o}C, made it unsuitable for practical applications. Recent findings of large ECE in several ferroelectric materials revived the interest in dielectric cooling based on ECE [1,2]. Here we show by direct ECE measurements via high resolution calorimeter that the large ECE is common in ceramic relaxor ferroelectrics. Large number of disordered fluctuating polarization entities and polar nanoregions can provide a scenario for achieving giant ECE, compared with normal ferroelectrics. The critical point proximity enhances the ECE similarly to the enhancement of the giant electromechanical response [2].

[1] A.S. Mischenko et al., Science 311,1270 (2006); B. Neese et al., Science vol. 321, 821 (2008).
[2] Z. Kutnjak et al., Nature 441, 956 (2006).